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THE IMPLEMENTATION OF THE DEPM IN WESTERN HORSE MACKEREL DURING THE TRIENNIAL MACKEREL AND HORSE MACKEREL SURVEYS (MEGS): PROS AND CONS.

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INTRODUCTION

In the western area, the **mackerel and horse mackerel egg survey** has been running continuously on **a triennial basis** since 1977 and since 1992 has also sampled the southern spawning component. It typically takes place between **February and July** and aims to cover the entire spawning area from Cadiz in the south to Northwest Scotland and since 2010, up to the waters around the Faroe Islands and southeast of Iceland.

Based on the observations from egg surveys in 2007 and 2010, which indicated that mackerel and horse mackerel have an indeterminate fecundity type, WGMEGS[1] coordinated the Workshop on Survey Design and Mackerel and Horse Mackerel Spawning Strategy (ICES, 2012). It recommended that MEGS survey should apply the **AEPM**[2] as in previous years along with the **DEPM**[3] from 2013 on, and for 5 consecutive surveys. The DEPM will try to carry out an intensive sampling in the peak spawning of mackerel and horse mackerel to attempt a DEPM SSB[4] estimate, and thereby facilitate the **comparison** of both to be able to **transform the historical** annual series to daily. The peak spawning area was defined (Fig.1) based on previous WGMEGS spawning results in the perceived peak spawning period.

The goal of this analysis is to illustrate the problems associated to the application of the DEPM on horse mackerel based on the MEGS survey.

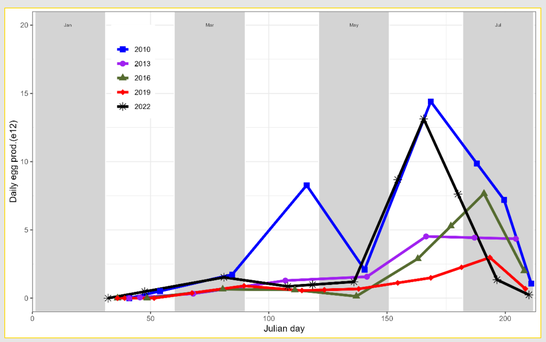

Figure 1. Western horse mackerel daily egg production (source: WGMEGS, 2022).

[1] Working Group on Mackerel and Horse mackerel egg survey [2] Annual Egg Production Method; [3]Daily Egg Production Method; [4]Spawning Stock Biomass.

DEPM specific adult's parameters

Parameter	Definition	Sample's Requeriment	Needed/Desirable
Batch Fecundity	The number of eggs released by batch	Hydrated ovaries without POFs[5]	High number of hydrated females
Spawning Fraction	The frequency at which each batch is realized	All mature females	Validated POFs' age
Sex Ratio	The proportion of male to female	All mature females	Good representation of samples
Female Mean Weight	Mean female weight	All mature females	Good representation of samples

[5] Post Ovulatory Follicle

What issues are we encountering?

Issues	Solution	Constraints
Low fish collection success	○ Increase the number of hauls ○ Support from commercial fishery and other scientific surveys (in 2022)	• Ship time limitation • Trained personnel to take the samples
Low number of hydrated ovaries	○ Increase the number of hauls	• The period of the peak of spawning varies and may not match the one selected for the DEPM
Uncertain POFs' age	○ Design experiments to define well this variable	• Funding to develop the research
Low number of females to estimate spawning fraction	○ Increase the number of hauls	• Ship time limitation • Trained personnel to take the samples

RESULTS AND DISCUSSION

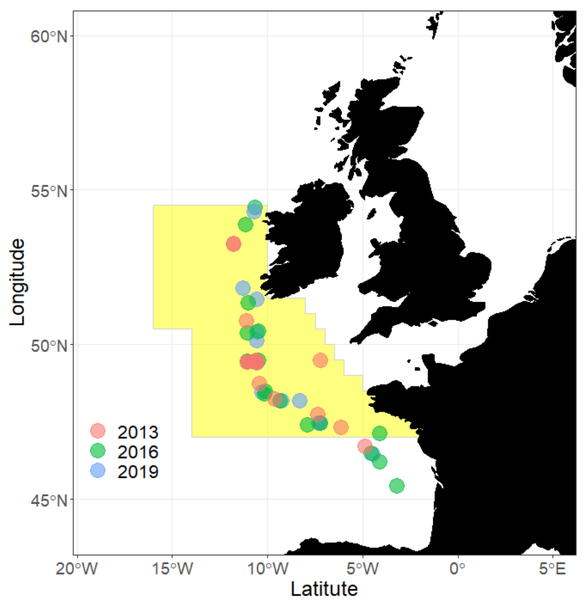

Figure 2. Spatial distribution of Western horse mackerel adults (source: ICES, 2021). The area for the sampling of adults for DEPM is enhanced.

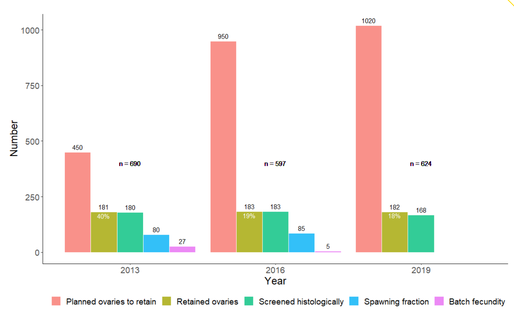

Figure 3. The graph illustrates the sequence in the ovary selection process. The numbers indicate the ovaries selected at each step and the n refers to the total number of individuals collected in the survey. (source: ICES, 2021).

Table 1. Summary of main results obtained on the application of DEPM for the last 3 surveys. In brackets the number of samples.

Parameter	2013	2016	2019
Periods	4 – 26 June	31May - 19 July	NA
Relative Batch fecundity (n/g)	72.02 (27)	157-331 (5)	
Spawning fraction	11% (80)	11-33% (183)	
Sex ratio	0.5 (690)	0.503 (597)	
Female average weight (g)	251.38 (181)	283.03 (183)	
SSB (millions tonnes)	0.74	0.29-0.37	

○ The hauls were well distributed in the peak of the spawning area but low in number, never above 17, and quite constant over the years (Fig.2). The maximum sampling capacity seems to be around this number.

○ The number of ovaries retained was similar over the years and it never achieved the planned number (Fig.3). This may be related to the low population biomass and/or to the spatio-temporal variation of the peak of spawning.

○ The number of ovaries then used to estimate DEPM adults' parameters were low (Table 1), which seriously questions the validity of these results as a proxy for the Western horse mackerel biomass index.

CONCLUSION

Although the MEGS survey offers an **excellent sampling opportunity** in terms of **organization and coverage**, the application of the DEPM for Western Stock of horse mackerel has not yielded successful results. Serious **difficulties** were encountered during the surveys that are not easy to resolve straightforwardly. MEGS survey requires thus to **take actions to mitigate** these shortcomings. The collaboration with commercial and scientific surveys has been already implemented in 2022, and its goodness will be evaluated next year during the WGMEGS meeting.

ACKNOWLEDGEMENTS

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